



## IS TRANSCRANIAL DIRECT CURRENT STIMULATION (tDCS) EFFECTIVE FOR IMPROVING APHASIA IN ADULTS WITH APHASIA AFTER STROKE? – A COCHRANE REVIEW SUMMARY WITH COMMENTARY

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**The aim of this commentary is to discuss in a rehabilitation perspective the published Cochrane Review “Transcranial direct current stimulation (tDCS) for improving aphasia in adults with aphasia after stroke” (1) by Elsner B, Kugler J, Pohl M, Mehrholz J<sup>1</sup>, under the direct supervision of Cochrane Stroke Group. This Cochrane Corner is produced in agreement with the *Journal of Rehabilitation Medicine* by Cochrane Rehabilitation.**

Key word: aphasia; speech therapy; stroke; rehabilitation.

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### BACKGROUND

Stroke is one of the leading causes of disability worldwide (2). It gives rise to various impairments with long-term consequences for the stroke survivors, such as aphasia. Aphasia is a devastating language disorder following brain damage that affects some or all modalities of language processing, including expression and understanding of speech, reading, and writing (3). Approximately one third of stroke survivors experience aphasia. A recent systematic review reported that post-stroke aphasia frequencies were 30% and 34% for acute and rehabilitation settings, respectively; and there were trends toward a continued high frequency of aphasia over long-term with less than 10% reduction at one year follow-up (4). People with post-stroke aphasia

are more likely to have longer hospital stays, higher odds of in-hospital deaths, greater disability and more use of rehabilitation services compared with stroke survivors without aphasia (4,5,6). They also report significantly worse health-related quality of life as well as higher depression and reduced long-term participation in the society (7). Therefore, effective rehabilitation interventions for aphasia are essential to minimise these profound effects on people’s lives. There are several approaches in the management of aphasia with some evidence for the effectiveness of speech and language therapy (SLT) (3). It is recommended that all stroke survivors with communication disorders should receive SLT, individually tailored according to their needs (8). Although SLT remains the mainstay of aphasia rehabilitation, transcranial direct current stimulation (tDCS), a neuromodulation technique, is a promising adjunctive therapy method to improve aphasia (9). tDCS works by applying direct current to the brain by means of two scalp electrodes so that excitatory stimulation (anodal) over the damaged hemisphere or inhibitory stimulation (cathodal) over the contralesional hemisphere could theoretically reduce inter-hemispheric imbalance after stroke, therefore improve language recovery (10). It is a safe, non-invasive, inexpensive and easy to use technique. A Cochrane review (1), an update of two previous reviews (11,12) addressed recent evidence on the effectiveness of tDCS for people with post-stroke aphasia.

### TRANSCRANIAL DIRECT CURRENT STIMULATION (TDCS) FOR IMPROVING APHASIA IN ADULTS WITH APHASIA AFTER STROKE

(Elsner B, Kugler J, Pohl M, Mehrholz J, 2019)

### WHAT IS THE AIM OF THIS COCHRANE REVIEW?

The aim of this Cochrane Review was to assess the effects of tDCS for improving post-stroke aphasia.

<sup>1</sup>This summary is based on a Cochrane Review previously published in the Cochrane Database of Systematic Reviews 2019, Issue 5, Art. No.: CD009760, DOI: 10.1002/14651858.CD009760.pub4 (see [www.cochranelibrary.com](http://www.cochranelibrary.com) for information). Cochrane Reviews are regularly updated as new evidence emerges and in response to feedback, and Cochrane Database of Systematic Reviews should be consulted for the most recent version of the review. The views expressed in the summary with commentary are those of the Cochrane Corner author and do not represent the Cochrane Library or Wiley.

## WHAT WAS STUDIED IN THE COCHRANE REVIEW?

The population addressed in this review was people aged 18 years and above, who had had a stroke, regardless of type or level of impairment or time since stroke. The interventions studied were tDCS alone or tDCS plus SLT or any other approach aiming to improve aphasia. The intervention was compared to sham tDCS alone or sham tDCS plus SLT or any other approach for aphasia, or no intervention in randomized controlled trials (RCT) and randomized controlled cross-over trials. Primary outcomes studied were formal outcome measures for functional communication (ability to communicate in an everyday communicative situation). Secondary outcomes were surrogate parameters of language impairment (receptive and/or expressive language), other domains of cognition (e.g. working attention, memory, executive functions, intelligence, visual-auditory recognition and visual-spatial abilities), dropouts, and adverse events.

## SEARCH METHODOLOGY AND UP-TO-DATENESS OF THE COCHRANE REVIEW?

The review authors searched for studies that had been published up to June 2018 in Cochrane Stroke Group Trials Register, Cochrane Central Register of Controlled Trials, MEDLINE, Embase, CINAHL, AMED, Science Citation Index, and seven additional databases as well as World Health Organization International Clinical Trials Registry Platform, Stroke Trials Registry, ClinicalTrials.gov, reference lists of relevant reviews, articles and textbooks, handsearched conference proceedings, and contacted authors and equipment manufacturers.

## WHAT ARE THE MAIN RESULTS OF THE COCHRANE REVIEW?

The review included 21 studies involving 421 participants in the qualitative synthesis. Fourteen of the studies, with 153 analysed participants, were randomised cross-over trials, whereas the remaining 7 studies, with 268 analysed participants, were RCTs. The experimental groups received anodal tDCS or cathodal tDCS, or both (dual or bihemispheric), and the control groups received sham tDCS.

The review shows the following results:

**Effects of interventions for the main comparison ‘tDCS plus SLT versus sham tDCS plus SLT’ on outcome measures:**

- *Functional communication:* Three trials with 112 participants revealed no evidence of an effect regard-

ing functional communication at post-intervention (low quality evidence). Two studies with 80 participants showed no evidence of an effect regarding functional communication at follow-up (very low quality evidence).

- *Language impairment: accuracy of naming nouns:* Eleven trials with 298 participants revealed evidence of a positive effect regarding accuracy of naming nouns at post-intervention (moderate quality evidence). Two studies with 80 participants showed evidence of a positive effect regarding accuracy of naming nouns at follow-up (low quality evidence).
- *Language impairment: accuracy of naming verbs:* Three trials with 21 participants showed no evidence of an effect regarding accuracy of naming verbs at post-intervention (very low quality evidence). No studies measured accuracy of naming verbs at follow-up.
- *Cognition:* No studies were found evaluating the effect of tDCS on cognition in post-stroke aphasia.
- *Dropouts and adverse effects:* There was no evidence of effect regarding the difference in dropouts between intervention and control groups (low quality evidence). No serious adverse events were reported.

### Pre-specified subgroup analysis

- *Comparison by time since stroke (acute or subacute versus chronic):* There was no evidence for different effects of tDCS on functional communication between acute (first month after stroke) or subacute (2–6 months) and chronic (more than 6 months) phases of stroke.
- *Comparison by location of stimulation (lesioned or non-lesioned hemisphere) and type of stimulation (anodal, cathodal, dual):* There was no evidence for different effects of tDCS on functional communication in terms of both location and type of stimulation.
- *Comparison by type of aphasia (fluent, non-fluent, mixed):* Treatment effect of tDCS on accuracy of naming nouns did not significantly differ between different types of aphasia.

## HOW DID THE AUTHORS CONCLUDE?

The authors concluded that there was no evidence of effectiveness of tDCS (anodal, cathodal, dual) over control (sham tDCS) for improving functional communication and language impairment in terms of naming verbs, the evidence being low and very low quality, respectively in people with post-stroke aphasia. However tDCS was found to improve language impairment in terms of naming nouns both at the end of the intervention (moderate quality evidence) and possibly at follow-up (low quality evidence). The authors have not recommended the routine use of tDCS for aphasia

after stroke as further methodologically rigorous RCTs are needed to determine its effectiveness in this respect.

## WHAT ARE THE IMPLICATIONS OF THE COCHRANE EVIDENCE FOR PRACTICE IN REHABILITATION?

A promising, non-invasive, adjuvant treatment approach in the rehabilitation of post-stroke aphasia is tDCS which might augment the effectiveness of SLT (9). Several previous studies which were evaluated in systematic reviews or meta-analyses reported the beneficial effects of tDCS on language performance for post-stroke aphasia in chronic stages (10, 13, 14). An assessment of naming tasks for language impairment was used as the outcome measure in almost all of those studies. However, based on the International Classification of Functioning, Disability and Health (15), an improvement in language functions such as naming may not be followed by enhancement in activities and participation (16). From the rehabilitation medicine perspective, it is important to document the effectiveness of tDCS on communication activity - that is ability to communicate in an everyday life situation. In this respect, the present Cochrane Review selected functional communication as the primary outcome and conveyed the message that tDCS did not have beneficial effects on functional communication regardless of phases of stroke (acute/subacute versus chronic) (1). The quality of evidence was low with only 3 trials and there was heterogeneity regarding trial design and stimulation parameters of tDCS. Therefore further RCTs with rigorous methodology and adequate sample size are needed to determine the effects tDCS not only on communication but participation in the society and quality of life as well.

Moderate quality of evidence in this Cochrane review confirmed the earlier findings regarding the beneficial effects of tDCS on naming nouns. Another important message conveyed by this review is that there were no studies investigating the effects of tDCS on other cognitive functions in aphasic stroke patients (1). This is probably because commonly used cognitive assessment tools may not be feasible for people with aphasia (17,18). Therefore, further studies exploring the association between aphasia and non-linguistic cognitive functions with appropriate cognitive assessment tools for aphasics would be helpful in order to direct neuromodulation therapies for other cognitive targets in people with post-stroke aphasia.

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